CLAIMS

1. Modular and software definable pre-amplifier apparatus (used to perform audio signal conditioning before being output to power amplification and or headset means) comprising:

(a) one or a plurality of software and or firmware definable logic blocks, these logic blocks being based on Programmable Logic Devices (PLDs), such as Field Programmable Gate Arrays (FPGAs), which can be configured in real time and or non real time to implement in hardware different signal processing functions required for different digital signal processing algorithms and or audio processing protocols, such as Dolby noise reduction, AC3, MPEG2, MP3, MPEG4, Home Theatre, various types of digital filters, thus allowing the apparatus to be used in different audio system configurations, the programmable logic optionally providing hardware acceleration of complex and software intensive functions, the configuration of the software definable logic blocks being performed by either firmware stored in local memory associated with the programmable logic devices and or by the host processor transferring the configuration data to the programmable logic devices directly or indirectly to local memory associated with the programmable logic devices or via a JTAG port of the programmable logic device, the choice of configuration firmware program depending on the user selected parameters, these parameters being entered into the apparatus via either an integrated keypad and front panel controls and or via remote control means, or personal computer means, the input information being displayed on display means, such as an Liquid Crystal Display (LCD), the software definable logic blocks optionally incorporating digital signal processor (DSP) devices and associated memory devices, the configuration and allocation of the software programs used by each digital signal processor device being performed in real time and or non real time by the host processor or configuration routines stored in non-volatile memory associated with the digital signal processors, the allocation of the specific software program being determined by user inputs;

(b) a host processor and associated program memory means for controlling, monitoring and configuring the apparatus.

2. Modular and software definable pre-amplifier apparatus as claimed in Claim 1 having integrated memory means, such as a hard disk drive and or non-volatile semiconductor memory and or volatile semiconductor memory for storing and retrieving digitised audio data signals.

3. Modular and software definable pre-amplifier apparatus as claimed in any preceding claim having mezzanine and or card modules which allows the

apparatus to be expanded or upgraded for use with other protocols or for adding more audio output channels and or accommodating more source channel interfaces, is accomplished by interfacing mezzanine or card modules to the apparatus, these mezzanine and or card modules containing any combination of the following circuitry;

1). Digital Signal Processor,
2). Memory,
3). Programmable Logic Devices (PLDs),
4). Interface logic,
5). Analogue to Digital Converter (ADC),
6). Digital to Analogue Converter (DAC),
7). Small signal amplification and or filter circuitry.

4. Modular and software definable pre-amplifier apparatus as claimed in any preceding claim which includes modem means, allowing Internet access so the user to download upgrade firmware or software for implementing new audio protocols and or configuring the programmable logic hardware and or signal processing algorithms allowing the programmable logic and processing elements in the apparatus to be reconfigured to implement the new algorithms and or hardware configurations, the new firmware and software being stored in non-volatile memory under the control of the host processor and controller circuitry, the Internet access also allows the user to download audio information, such as MP3 data, which can then be processed and optionally stored by the apparatus before being output to other apparatus, such as a power amplifier and or headset.

5. Apparatus as claimed in any preceding claim which has the facilities to allow removable memory means, such as a PC TYPE 1 / 2 / 3 card or memory stick© to be inserted into the apparatus and removed from the apparatus, previously stored data being read from the removable memory means and processed by the apparatus before being output, alternatively processed music data and or digitised audio signals, formatted in the selected format, can be stored in non-volatile memory in the removable memory card allowing the user to play the recorded data on another apparatus which has the facilities to access the data stored on the removable memory card means.

6. Apparatus as claimed in any preceding claim in which the software and or firmware definable devices are full custom VLSI devices and or Application Specific Integrated Circuits (ASICs) which implement any combination of programmable logic, fixed standard cell logic, mixed signal circuitry and processor cores.

7. Apparatus as claimed in any preceding claim in which the input circuitry and or output circuitry is based on programmable logic devices, such as Field Programmable Gate Arrays (FPGAs), allowing the interfaces to be re-configured to implement the desired interface protocol or format.

8. Apparatus as claimed in any preceding claim in which the apparatus can be configured for simultaneous use by more than one user where signal data from one or more signal sources can be processed and output to one or more output circuits.

9. Apparatus as claimed in any preceding claim in which an external modem means is employed to access the Internet.

10. Apparatus as claimed in any preceding claim which uses feedback signals from remote microphone means to allow the signal processing means to adapt in real time the sound of the played music to the desired acoustical settings.

11. Apparatus as claimed in any preceding claim which incorporates Analogue to Digital converter (ADC) means to allow analogue input signals to be first converted to digital signals so they can be processed in the digital domain, the sampling frequency of the Analogue to Digital Converter(s) (ADCs) being sufficient to accurately represent the signal in the digital domain.

12. Apparatus as claimed in any proceeding claim in which the input signal to the apparatus from source means and or the output signals from the apparatus to signal sink means is by wireless communication means.

13. Apparatus as claimed in claim 12 in which the wireless protocol used to transfer data to and from the pre-amplifier apparatus is Bluetooth, HomeRF, IEEE 802.11, DECT or Wireless ATM.

14. Apparatus as claimed in claim 3 or claim 5 wherein the mezzanine card and or card module interface means are based on programmable logic, for example Field Programmable Logic Arrays (FPGAs) so upgrades can be easily implemented by changing the interface devices of the associated card module and or mezzanine card.

15. Apparatus as claimed in any preceding claim in which the signal processing blocks are programmed and or configured to implement reverberation and echo effects.

16. Apparatus as claimed in any preceding claim in which the signal processing blocks are programmed and or configured to emulate the acoustic characteristics of a valve amplifier and alter the output signals so they sound as if they were produced by a valve amplifier.

17. Apparatus as claimed in any preceding claim in which a personal computer (PC) can be connected to allow control of the apparatus, reconfigure the apparatus, diagnose the apparatus and or download or upload music data, which can be processed or stored in internal memory form future use.

18. Apparatus as claimed in any preceding claim in which the remote control means can be used to control the peripheral signal source apparatus, such as a compact disc player via the pre-amplifier apparatus.

19. Apparatus as claimed in any preceding claim in which digital switching means are employed to route and transfer data from different sub-blocks, card modules and or devices in the apparatus.

20. Apparatus as claimed in claim 19 in which the digital switching means takes the form of a cross bar switch or a self-routing switch in which data packets or cells have an appended routing tag to control the flow of the packet or cell through the self-routing switch to its destination.

21. Apparatus as claimed in claim 20 in which the digital switching means uses priority output queues to allow data with different priorities to be queued in separate queues to reduce congestion and head of line blocking.

22. Apparatus as claimed in any preceding claim in which digital data for transfer via switching means is encapsulated as a variable length data packet or same length cell.

23. Apparatus as claimed in any preceding claim which incorporates an integrated read and optionally write-able compact disc transport and associated control circuitry to allow stored digitised audio data to be read and or written to a compact disc (CD) media.

24. Apparatus as claimed in any preceding claim which incorporates an integrated read and optionally write-able Digital Versatile Disc (DVD) transport and associated control circuitry to allow stored digitised audio data to be read and or written to a Digital Versatile Disc (DVD) media.

25. Apparatus as claimed in any preceding claim where peripheral units are situated remotely from the pre-amplifier apparatus in which control and data messages are transferred by wireless means allowing movement of the said remote peripheral units to different locations within the user's house without the need to re-wire the apparatus.

26. Apparatus as claimed in claim 3 and claim 4 wherein the mezzanine cards and or card modules incorporate 'Plug and Play' means to allow a mezzanine card and or card module to configure and initialise itself and interact with the host processor means to indicate the configuration, status and functionality of the card module and associated mezzanine card modules.

27. Apparatus as claimed in claim 3 and claim 4 wherein the mezzanine cards and or card modules incorporate the means to be hot swappable allowing card module insertion or removal from the apparatus card frame while the apparatus is operational.

28. Apparatus as claimed in Claim 1 to Claim 5 in which the apparatus can have some of the programmable circuitry configured to implement functions and or algorithms normally performed in "conventional" peripheral equipment allowing new peripheral equipment which operates with the said modular and software definable pre-amplifier apparatus to have reduced functionality.

29. Apparatus as claimed in any preceding claim in which the apparatus can be programmed to record data using "non-volatile" memory means at a predefined time from a peripheral device so it can be retrieved, processed and listened to at a later time.

30. A modular, software definable pre-amplifier apparatus substantially as described herein with reference to Figures 1-7 of the accompanying drawings.